Topic: Angle of depression and elevation

Question: Which of the following most closely approximates the (overall) distance between Fluffy and Muffy when they're each at their favorite spot?

Two cats, Fluffy and Muffy, each have their own cat tree and their favorite spot in their tree. The horizontal distance between their favorite spots is 4.8 feet and the angle of elevation of Fluffy's favorite spot with respect to Muffy's is $35°$.

Answer choices:

A 7.75 feet

B 5.86 feet

C 8.37 feet

D 6.93 feet

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Solution: B

Let b be the horizontal distance between their favorite spots, and let c be the (overall) distance between their favorite spots. What we need to do is compute c from b and the angle of elevation.

Note that

$$\frac{b}{\cos 35^\circ} = \frac{c}{1}$$

That is,

$$\frac{b}{\cos 35^\circ} = c$$

Turning this equation around, we have

$$c = \frac{b}{\cos 35^\circ}$$

We are given that $b = 4.8$ feet. Substituting 4.8 for b, we get

$$c = \frac{4.8}{\cos 35^\circ}$$

Now

$$\cos 35^\circ \approx 0.819$$

Thus

$$c \approx \frac{4.8}{0.819} \approx 5.86 \text{ feet}$$

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Question: What is the horizontal distance between the drone and the tracking apparatus at that time?

A drone is cruising at an altitude of 750 feet. At a certain time, its angle of elevation with respect to a piece of tracking apparatus which is set up on a stand 25 feet above ground level is $49°$. Assume that ground level at the location of the tracking apparatus is the same as ground level at the location of the drone at the time in question.

Answer choices:

A 863 feet

B 630 feet

C 652 feet

D 834 feet

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Solution: B

Let a be the vertical distance between the drone and the tracking apparatus, and let b be the horizontal distance between them at the time in question. What we need to do is compute b from a and the angle of elevation.

Note that

$$\frac{a}{\sin 49^\circ} = \frac{b}{\cos 49^\circ}$$

We're given that the drone is flying at an altitude of 750 feet and the tracking apparatus is located 25 feet above the ground. Thus

$$a = 750 - 25 = 725 \text{ feet}$$

Substituting 725 for a, we have

$$\frac{725}{\sin 49^\circ} = \frac{b}{\cos 49^\circ}$$

Multiplying both sides of this equation by $\cos 49^\circ$ gives

$$\left(\frac{725}{\sin 49^\circ}\right)(\cos 49^\circ) = b$$

Turning this equation around:

$$b = \left(\frac{725}{\sin 49^\circ}\right)(\cos 49^\circ)$$

Now

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$$\sin 49^\circ \approx 0.755 \text{ and } \cos 49^\circ \approx 0.656$$

Thus

$$b \approx \left(\frac{725}{0.755}\right)(0.656) \approx 630 \text{ feet}$$

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Topic: Angle of depression and elevation

Question: How far away is the fish?

A man is trying to catch some fish and spots one with an angle of depression of $51°$ with respect to the end of his fishing rod. The fish is located 8.2 feet lower than the end of the fishing rod.

Answer choices:

A 13.0 feet

B 19.1 feet

C 9.16 feet

D 10.6 feet

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Solution: D

Let a be the vertical distance between the fish and the end of the fishing rod, and let c be the (overall) distance between them. What we need to do is compute c from a and the angle of depression.

Note that

$$\frac{a}{\sin 51^\circ} = \frac{c}{1}$$

That is,

$$\frac{a}{\sin 51^\circ} = c$$

Turning this equation around, we have

$$c = \frac{a}{\sin 51^\circ}$$

We are given that $a = 8.2$ feet. Substituting 8.2 for a, we get

$$c = \frac{8.2}{\sin 51^\circ}$$

Now

$$\sin 51^\circ \approx 0.777$$

Thus

$$c \approx \frac{8.2}{0.777} \approx 10.6 \text{ feet}$$

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